

Taxonomic changes in *Dicraneura* Hardy, *Colladonus* Ball and *Macrosteles* Fieber (Homoptera-Auchenorrhyncha) in the Montane Cordilleran Ecozone

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ABSTRACT

A neotype is proposed for *Typhlocyba carneola* Stål, 1858 (= *Dikraneura carneola* var. *shoshone* DeLong & Caldwell, 1937, syn.nov.), and *Dikraneura sitkana* Ball & DeLong is elevated to specific rank for the taxon previously known as *Dikraneura carneola*. Five other species are described from the Montane Cordilleran Ecozone: *Colladonus keltoni* Hamilton, *Colladonus okanaganus* Hamilton, *Macrosteles frigidus* Kwon, *Macrosteles similis* Kwon and *Macrosteles vulgaris* Kwon.

INTRODUCTION

Eleven apparently undescribed species were discovered during the preparation of a faunal synopsis of the Montane Cordillera Ecozone (MCE) of British Columbia. Six of these species belong to well studied genera. *Colladonus* Ball was revised by Nielson (1957) for the species north of Mexico and 6 species have been added subsequently (Nielson 1962, Hamilton and Langor 1987); this contribution adds two more. *Dikraneura* Hardy was revised by Knight (1968) and a former synonym is elevated to specific status following designation of a neotype for the species with which it has been confused. *Macrosteles* Fieber is a large genus discussed by Kwon (1988, unpublished); his dissection techniques and five of his new species from the Atlantic Maritime Ecozone will appear elsewhere (Hamilton and Kwon 2010) and three others, occurring in the MCE, are formally described below.

Four other species belong to the typical subgenus *Empoasca* Walsh, which is a taxon with more than 600 species; it is in need of revision before any additional species are described. A fifth species is known only from a single female. Since it belongs to the Delphacid genus *Delphacodes* Fie-

ber, in which only males can be recognized with certainty, no formal description can be presented.

Specimens and notes examined in this study are deposited in the following institutions:

AMNH: American Museum of Natural History, New York.

CNC: Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, ON

GL: Grassland Leafhopper survey; field notes from H.H. Ross in CNC.

MLBM: Monte L. Bean Life Science Museum, Brigham Young University, Provo, UT

NCSU: North Carolina State University, Raleigh

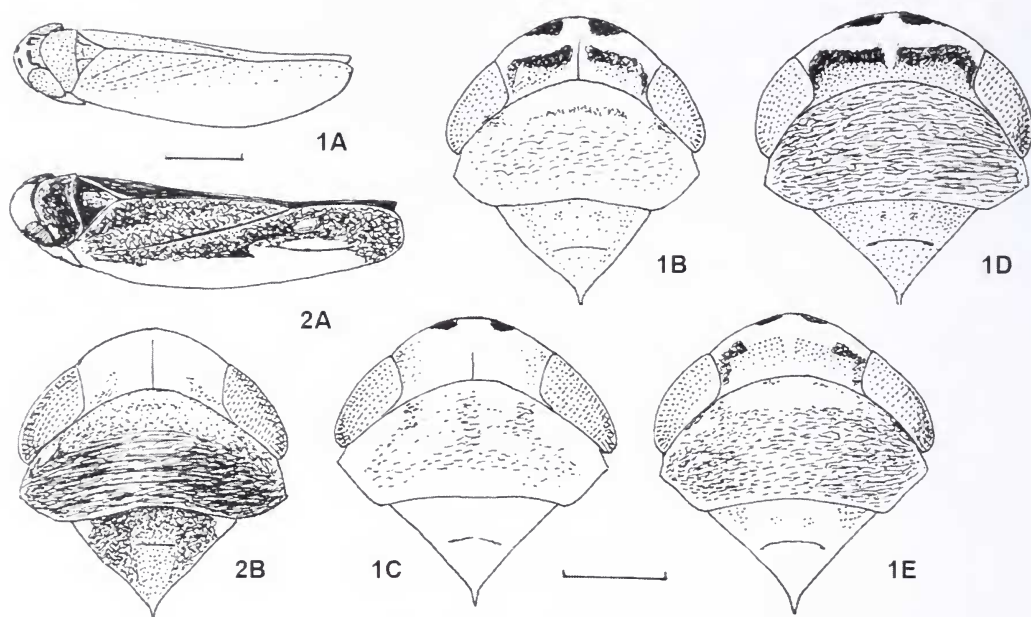
OrSU: Oregon State University, Corvallis

***Colladonus keltoni* Hamilton, sp.n.**

Diagnosis. Crown slightly less than half as long as wide, apically rounded (Fig. 1B-E); colour uniform brown, paler on tegmina, unmarked except for crown of head: apex with 2 black spots and usually also a mustache-shaped mark between eyes; tegmina hyaline with dark hind wing veins visible (Fig. 1A). Male genitalic characters

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Figures 1-2. *Colladonus* spp. 1, *C. keltoni*; 2, *C. okanaganus*: A, habitus, dorsolateral aspect; B-C, dorsum of male; D-E, dorsum of female. Habitus to larger scale (1 mm), dorsum to smaller scale (0.5 mm).

as in *C. ponderosus* Ball (Nielson 1957, figs. 4A, C): male pygofer produced on caudoventral margin and bearing a short spine at tip; style tips curved outwards, but with gonopore at midlength of shaft, and terminal processes extending at least half length of shaft, as in *C. tahotus* Ball (Nielson 1957, fig. 47B). Length: male, 4.5-4.9 mm; female, 4.8-5.2 mm.

Types. Holotype male, **B.C.-** Cranbrook, 23 July 1959 (L.A. Kelton). Paratypes: 3 females, same data as holotype; 3 females, Yahk, 22 July 1959 (L.A. Kelton), lodgepole [pine]; 1 female, Penticton, 27 June 1974 (M.W. Nielson); 1 male, Okanagan Mission, 18 June-2 July 1971, sticky board on *Prunus emarginata*; 1 male, same data, 1-16 July 1971; 1 male, Bear Creek (Okanagan Valley), 8 Aug. 1970 (K.G.A. Hamilton); 1 female, Okanagan Falls, 4 July 1976 (K.G.A. Hamilton); 1 female, Little Fort, 3 July 1976 (K.G.A. Hamilton); 2 males, Elko, 14 Aug. 1985 (K.G.A. Hamilton); **MT-** 1 male, 5 km E Grantsdale, 3 June 1992 (K.G.A. Hamilton). All types (7 males, 8 females) No. 21835 in CNC.

Remarks. All females and the darkest

males may be distinguished by the head markings. This is one of three species of *Colladonus* that are associated with pines, all of which have strongly produced male pygofers. The combination of genitalic characters distinguishes males from the other two pine species, *C. ponderosus* and *C. tahotus*.

***Colladonus okanaganus* Hamilton, sp.n.**

Diagnosis. Crown slightly less than half as long as wide, apically rounded (Figs. 2B); head and venter yellow, strongly contrasting with blackish brown notum and tegmina; costa and small spots on preapical cells hyaline (Fig. 2A). Male genitalic characters as in *C. flavocapitatus* (Van Duzee): pygofer spine arising from midlength of truncate pygofer tip, styles tips long and curved outwards, and terminal processes of aedeagus extending to midlength of shaft (Nielson 1957, figs. 45 A-C), but with process of pygofer slightly longer, as long as terminal processes of aedeagus, and gonopore basad of midlength of shaft (as in Nielson 1957, fig. 19B). Length: male, 4.6-5.0 (holotype); female unknown.

Types. Holotype male, **B.C.-** Okanagan Mission site 12 (Okanagan Valley), 30 July

1974 (J.E.H.). Paratypes: 1 male, Armstrong, 15-29 July 1971, sticky board on *Prunus emarginata*; 1 male, Penticton, site 1 SB, 18 July 1974 (J.E.H.). All types No. 21835 in CNC.

Remarks. The boldly contrasting colour is similar only to that of an undescribed species of *Colladonus* from the west coast of Vancouver Island.

***Dikraneura carneola* (Stål)**

Typhlocyba carneola Stål, 1858: 196 (Sitka Island, Alaska).

Dikraneura carneola var. *shoshone* DeLong & Caldwell, 1937: 27, **syn.nov.** (Idaho).

Diagnosis. This species is closely allied to a sister species, formerly considered as a “variety” *sitkana* (name elevated to specific rank, below). The latter differs in minor details of male genitalia and has a more southerly range (Figs. 3-4), overlapping that of *D. carneola* in southern B.C. to Idaho.

Remarks. This taxon was described from unusually pinkish specimens. Ball and DeLong (1925) considered the species to be very widespread in western North America, with variable colour. Specimens from Utah were especially yellower and were named as “var. *sitkana*,” possibly as geographic variants, but more probably these are ecophenotypes. Later, DeLong & Caldwell (1937) figured the male genitalia for the first time. They considered the genitalic characters to be variable and associated the widespread “*D. carneola*” with a different aedeagal type than that of “var. *shoshone*” from Idaho. Knight (1968) concluded that these two aedeagal types represent separate species. Lack of material from Alaska prompted him to retain the name “*D. carneola*” for the widespread species. However, 78 specimens were later taken close to Sitka at Haines (1 nymph, 12 males, 16 females, GL 1142) and Potter (14 males, 35 females, GL 1127). Five males dissected from each series are referable to *D. shoshone*. A female from much farther northwest on coastal Alaska (King Salmon) is probably conspecific. Three males from inland sites in northwestern Canada (Banff, AB; Atlin and Chicotin, BC) indicate that

the coastal populations have a montane connection to the southern BC and ID populations. The two names are therefore synonyms and the southern “variety” is indeed a valid species.

Types. Stål’s types have been sought, but have not been found (Knight 1968). Neotype of *carneola*, here designated: male, AK- Haines, 5 August 1968 (Ross, Ross & Miller) GL 1142.

***Dikraneura sitkana* (Ball & DeLong), stat.nov.**

Typhlocyba carneola var. *sitkana* Ball & DeLong, 1925: 330.

Typhlocyba carneola: Knight, 1968: (misidentification).

Diagnosis. Characters and distribution as in Knight (1968) for *D. carneola* [nec Stål], but the single female of “*carneola*” from Edmonton, AB cannot be positively identified. This female probably belongs to the common prairie-inhabiting *D. variata* Hardy, which sometimes has pinkish females.

Material examined: 52 males, 66 females from B.C.- Baldy Mtn. 7000-7550' [2300-2500 m ASL], 13 Aug. 1970 (K.G.A. Hamilton); 48 males, 48 females, MT- Bozeman, 9 Sept 1971 (H.H. Ross) [GL] 1271. All types No. 21835 in CNC. Ten males from each of these series were dissected to verify that there is no admixture of other species.

***Macrosteles frigidus* Kwon, sp.nov.**

Diagnosis. Yellow to yellowish green, often with faint smoky tint on tegmina (Fig. 5A-B). Crown with anterior margin rounded in male, more or less pointed in female; anterior black spots isolated, subequal in size to posterior spots, which are always prominent and isolated; median and lateral spots absent; frons without any prominent dark streaks (Fig. 5C-E). Tegmina more or less mottled with large, discoid pale areas. Male abdomen with 1st acrotergite only as broad as long, 2nd acrotergite with “neck” shorter than half of acrotergite width; 1st tergal apodeme reaching posteriorly to two-thirds of tergite length (Fig. 5F); 1st sternal apodemes with posterior lobes slightly longer (1.1-1.2 ×)



Figures 3-4. Ranges of *Dikraneura* spp. 3, *D. carneola*; 4, *D. sitkana*.

than wide (Fig. 5G, J-L); 2nd sternal apodemes with posterior lobes slightly exceeding twice basal width (Fig. 5N-Q); apophysis processes narrowly produced (Fig. 5M). Aedeagal shaft in posterior aspect (Fig. 5W-Z) with apical processes reflexed basally, crossed, extending nearly to middle of shaft, and subapex narrowed, bearing paired lateral teeth slightly above gonopore; in lateral aspect (Fig. 5S-V) more or less convex subapically on dorsal side, spiculate ventrobasally; subgenital plates (Fig. 5R) each with mesal margin about as long as basal margin. Length: male, 2.9-3.2 mm; female, 3.2-3.4 mm.

Types. Holotype male, **B.C.**- Quesnel, 31 Aug. 1948 (G.J. Spencer). Paratypes: 5 females, same data as holotype; 2 males, 4

females, Minnie Lake, 27 July 1925 (H.G. Crawford); 3 males, 4 females, Stanley, 3 Aug. 1949 (R. Stace-Smith); 2 males, 1 female, 7 mi S of Nelson, 6 Aug. 1969 (P. Oman); **Alta.**- 3 males, 4 females, Wainwright, 27 July 1957 (A.R. & J.E. Brooks); 1 male, High Prairie, 17 July 1961 (A.R. Brooks); 1 male, Grande Prairie, 26 July 1961 (A.R. Brooks); **Sask.**- 1 male, Torch R., 20 July 1950 (L.A. Konotopetz); 1 male, 2 females, Prince Albert, 23 July 1959 (A.R. & J.E. Brooks); 1 male, Saskatoon, 1 Aug. 1960 (A.R. Brooks); **Man.**- 2 males, 2 females, Virden, 9 July 1953 (Brooks & Kelton); **Y.T.**- 2 males, Snag, 24 July 1948 (Mason & Hughes); **AK.**- 3 males, 1 female, Big Delta, 13 July 1951 (J.R. McGillis). Holotype and 41 paratypes

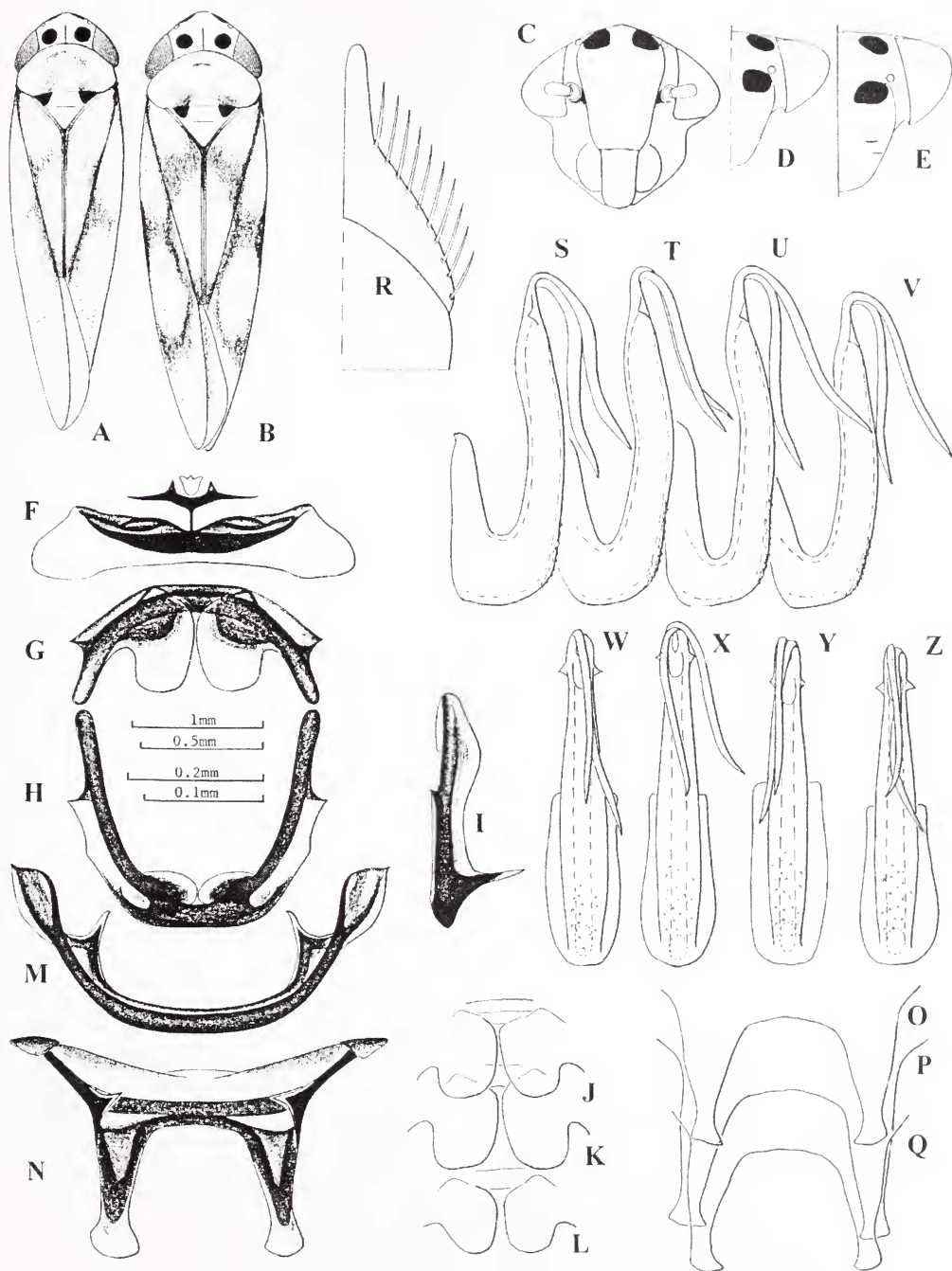


Figure 5. *Macrosteles frigidus*, based on specimens from B.C., except variants (from Yukon, Alta. and AK respectively): A, habitus of male, dorsal aspect; B, same, of female; C, male head in facial aspect; D, same, in anterior aspect; E, same, of female; F, male abdominal tergites 1-2 in dorsal aspect; G, male abdominal sternite 1 in dorso-anterior aspect; H, same, in anterior aspect; I, same, in lateral aspect; J-L, same, variation of outlines of sternal lobes; M, male abdominal sternite 2 in anterior aspect; N, same, in dorsal aspect; O-Q, same, variation of outlines of sternal lobes; R, male subgenital plate, ventral aspect; S-V, variation in aedeagus, lateral aspect; W-Z, same, posterior aspect. Habitus (A-B) to largest scale; face (C-E) to second largest scale; abdominal plates (F-R) to second smallest scale; aedeagus (S-Z) to smallest scale.

No. 22874 in CNC; 3 paratypes in OrSU and 1 paratype in NCSU.

Additional specimens, excluded from the type series, were examined from Texas (36 specimens), Alberta and Saskatchewan (3 specimens). The Texan morph has somewhat shorter head and apodemes, while the others have more strongly pointed heads, especially in the female.

Remarks. This species is similar to *M. galeae* Hamilton (in Hamilton and Langor 1987), but is readily distinguished by the very bold coronal spots between the eyes. From all other species in the genus with crossed aedeagal processes it may be distinguished by its convex subapex of the aedeagus in lateral aspect.

***Macrostes similis* Kwon, sp.nov.**

Diagnosis. Relatively elongate; yellow to yellowish green, often with very faint smoky tint on fore wings (Fig. 6A-B). Crown somewhat rounded in male, more or less pointed in female; black anterior spots often fused together with lateral spots to form a transverse band along coronal margin, and with median and lateral spots often confluent; frons with prominent, dark transverse bands on either side of median stripe (Fig. 6C-E). Tegmina with dark stripe along claval suture. Male abdomen with 1st acrotergite broad, 2nd acrotergite nearly transverse, triangularly produced ventrally, "neck" slender, less than half as long as width of acrotergite; 2nd tergal apodeme often reaching to middle of tergite (Fig. 6F); 1st sternal apodemes with posterior lobes usually as long as wide (Fig. 6G, J-L), slightly inclined in lateral aspect (Fig. 6I); 2nd sternal apodemes with posterior lobes about twice as long as basal width (Fig. 6N-Q); apophysis processes narrowly produced (Fig. 6M). Aedeagal shaft smooth ventrally, with serrate lateral flanges lying along anterior edge of shaft in lateral aspect, in posterior aspect (Fig. 6V-X) narrowly developed, apical processes slender, convergent, or crossed apically in posterior aspect, in lateral aspect (Fig. 6S-U) turned antiad, then hooked dorsad; subgenital plates each with mesal margin longer than basal margin (Fig. 6R). Length: male, 3.6-4.0 mm; fe-

male, 4.0-4.4 mm.

Types. Holotype male, **AK-** Big Delta, 13 July 1951 (J.R. McGillis). Paratypes: 1 female, same data as holotype; 1 male, 1 female, same locality, 30 June-26 July 1951 (W. Mason); 1 male, Fairbanks, 4 Aug. 1951 (H.C. Severin); 2 males, Circle Hot Spgs., 4 Aug. 1951 (H.C. Severin); **B.C.-** 3 males, Atlin 2200' [700m], 29-30 July 1955 (B.A. Gibbard); 1 male, 10 mi S of Revelstoke, 22 Aug. 1978 (K.G.A. Hamilton) on *Juncus* spp.; 1 male, Orchard Pt. bog, Brooks Pen., Vancouver Is., 4 Aug. 1981 (R.A. & S.G. Cannings); **N.W.T.-** 2 males, 4 females, Rocknest Lake 65°39'N 114°20'W, 26 Aug. 1966 (G.E. Shewell); **Qué.-** 5 males, Natashquan, 7 Aug. 1929 (W.J. Brown); **CO-** 1 male, 2 mi S of Gould, 9000' [2400m], 13 Aug. 1968 (P. Oman); **UT-** 16 males and 38 females, Uinta Mts. 10,000' [3000m], Uintah Co., 21 Aug. 1983 (M.W. Nielson) on *Carex* sp. Holotype and 22 paratypes No. 22876 in CNC; 54 paratypes in MLBM; 1 paratype in OrSU.

Remarks. Similar to *M. fieberi* (Edwards), but differing in the much shorter posterior lobes on the male 2nd sternal apodemes, and by the serrate lateral flanges of the aedeagus lying along the anterior edge of the shaft instead of along the sides (Beirne 1952, figs. 91-92). This aedeagal character appears to be variable in European populations of *M. fieberi*, but not in North American populations.

***Macrostes vulgaris* Kwon, sp.nov.**

Diagnosis. Yellow to yellowish green, frequently with smoky markings on body and tegmina (Fig. 7A-C). Crown broad, slightly more than twice as wide as long, often rounded in male, more or less pointed in female; spot pattern confluent or isolated, as in *M. quadrilineatus* (Forbes). Frons with black transverse bands usually confluent (Fig. 7D-G). Tegmina unmarked or faintly crossbanded. Male abdomen with 1st acrotergite very broad, 2nd acrotergite nearly transverse, triangularly produced ventrally, "neck" slender and elongate, only slightly shorter than acrotergite; 2nd tergal apodeme reaching middle of tergite (Fig.

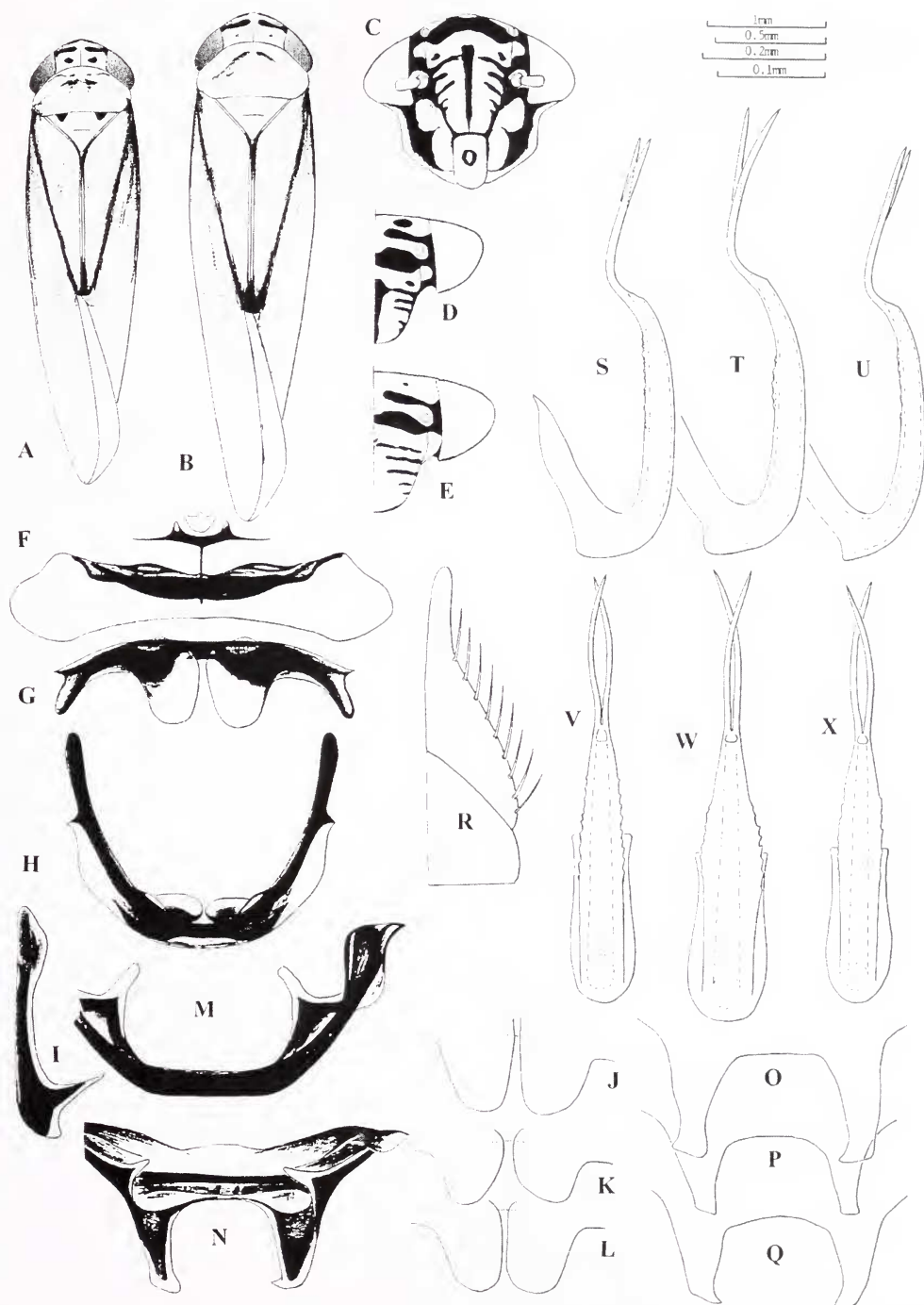


Figure 6. *Macrosteles similis*, based on males from Qué. and female from N.W.T.: A, habitus of male, dorsal aspect; B, same, of female; C, male head in facial aspect; D, same, in anterior aspect; E, same, of female; F, male abdominal tergites 1-2 in dorsal aspect; G, male abdominal sternite 1 in dorso-anterior aspect; H, same, in anterior aspect; I, same, in lateral aspect; J-L, same, variation of outlines of sternal lobes; M, male abdominal sternite 2 in anterior aspect; N, same, in dorsal aspect; O-Q, same, variation of outlines of sternal lobes; R, male subgenital plate, ventral aspect; S-U, variation in aedeagus, lateral aspect; V-X, same, posterior aspect. Habitus (A-B) to largest scale; face (C-E) to second largest scale; abdominal plates (F-R) to second smallest scale; aedeagus (S-X) to smallest scale.

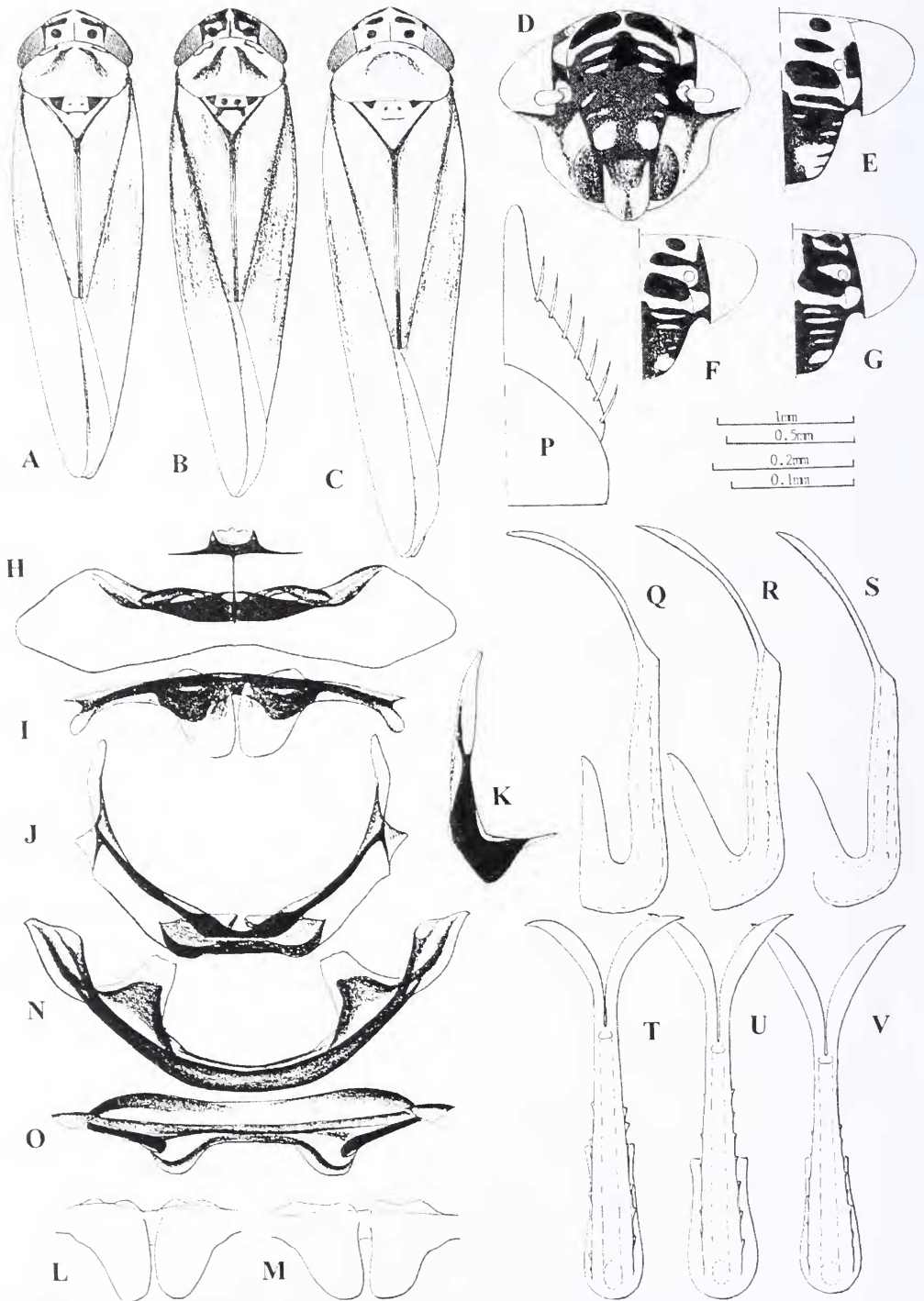


Figure 7. *Macrosteles vulgaris*, based on specimens from B.C.: A, B, habitus of male, dorsal aspect; C, same, of female; D, male head in facial aspect; E, same, of female in anterior aspect; F, G, same, of male; H, male abdominal tergites 1-2 in dorsal aspect; I, male abdominal sternite 1 in dorso-anterior aspect; J, same, in anterior aspect; K, same, in lateral aspect; L, M, same, variation of outlines of sternal lobes; N, male abdominal sternite 2 in anterior aspect; O, same, in dorsal aspect; P, male subgenital plate, ventral aspect; Q-S, variation in aedeagus, lateral aspect; T-V, same, posterior aspect. Habitus (A-C) to largest scale; face (D-G) to second largest scale; abdominal plates (H-P) to second smallest scale; aedeagus (Q-V) to smallest scale.

7H); 1st sternal apodemes with posterior lobes about as long as basal width (Fig. 7I, L-M); apophyses abruptly bent at middle in anterior aspect (Fig. 7J), dorsal aspect with lower part narrower than median part between posterior lobes; 2nd sternal apodemes apically truncate (Fig. 7N) with posterior lobes reduced, triangular (Fig. 7O). Aedeagus (Fig. 7Q-V) as in *M. quadrilineatus*; subgenital plates each with mesal margin longer than basal margin (Fig. 7P). Length: male, 3.2-3.7 mm; female, 3.5-4.2 mm.

Types. Holotype male, **B.C.**- Cowichan Lake, 6 June 1955 (R. Coyles). Paratypes: 65 males, 30 females, same data as holotype; 8 males, Kootenay Bay, 23 June-29 Aug. 1948-49 (D.B. Waddell); 1 male, Soda Creek, 21 July 1950 (G.J. Spencer); 1 male, 3 females, Malahat, 20 Sept. 1950 (W. Downes); 22 males, 11 females, Oliver 2500' [800m], 2 July 1953 (J.R. McGillis); 1 male, Diamond Head Trail 3200' [1000m], Squamish, 7 Aug. 1953 (G.J. Spencer); 1 male, 6 females, Duncan, 9 June 1955 (R. Coyles); 1 male, 5 females, Miracle Is. Park, 11 June 1955 (R. Coyles); 3 males, 3 females, same locality, 29 May 1959 (R. Madge & R.E. Leech); 1 male, Spectacle Lake, Oliver, 10 June 1959 (L.A. Kelton); 11 males, 14 females, Terrace, 15 July-3 Aug. 1960 (W.R. Richards); 1 male, Shames, 18 mi SW of Terrace, 17 July 1960 (C.H. Mann); 8 males, 11 females, 5 mi E of Sidney, 23 Aug. 1971 (J. Sawbridge); **Man.**- 1 male, Shoal Lk., 28 June 1976 (K.G.A. Hamilton) on *Distichlis stricta*; **Sask.**- 1 male, Pipestone Creek, 7 June 1958 (A.R. Brooks); **CA.**- 3 males, Truckee, Nevada Co., 29 Aug. 1967 (L. Kelton); 1 male, 1 female, 38 mi SE Mt. Shasta, 10 July 1972 (P. Oman); 1 male, 4 females, 18 mi W of Susanville 5400' [1530m], 10 July 1972 (P. Oman); 1 male, 7.6 mi N of Bridgeport, 19 June 1982 (P. Oman); 1 male, 2 females, Squaw Valley, Placer Co., 5 Oct. 1983 (D.G. Denning); **ID.**- 1 male, Paris, 8 July 1920 (F 4741); **MT.**- 1 male, 24 females, Bozeman, 9 Sept. 1971 (H.H. Ross); **OR.**- 6 males, 5 females, Corvallis, 14 Aug. 1928 (O.A.

Hills); 1 female, same data, but 4 July 1927; 1 male, Lostine, 12 Aug. 1929 (O.A. Hills); 10 males, Gresham, 8 July 1949 (R. Rosenstiel) on strawberry; 1 male, Astoria, 13 June 1951 (E.A. Dickason); 1 male, Oregon City, 28 Aug. 1962 (Koontz) on potato; 6 males, 3 females, Forest Grove, 2 July 1965 (F.P. Larson) black light trap; 3 males, Woodburn at Pudding R., 26 July 1965 (F.P. Larson) black light trap; 3 males, same data, but 11 Sept. 1966; 1 male, Hillsboro, 28 July 1965 (F.P. Larson) black light trap; 2 males, Troutdale, 18 July 1966 (F.P. Larson) black light trap; 2 males, 2 females, Canby, 29 Aug. 1966 (F.P. Larson) black light trap in corn; 3 males, Lily Lake 13 mi E of French Glen 7200' [2000m], 10 July 1968 (P. Oman); 3 males, MacDonald Forest at Corvallis, 17 July 1968 (P. Oman); 2 males, 6 females, Seal Rock, 31 Aug. 1968 (P. Oman); 8 males, 13 females, same data, but 1 May 1970; 4 males, 5 females, same data, but 1-27 May; 1 male, 2 mi NW of Banks, 18 June 1969 (P. Oman); 1 male, 25 mi SE of Joseph, 10 Aug. 1969 (P. Oman); 7 males, 5 females, Tou Velle Park, Jackson Co., 2 May 1970 (P. Oman); 1 male, 3 females, Agate Desert, Jackson Co., 2 May 1970 (P. Oman); 1 male, 2 females, same data, but 19 May 1971; 1 male, 2 females, Joseph, 6 June 1970 (P. Oman); 1 male, 10 mi ESE of Ruch, 14 May 1971 (P. Oman); 10 males, 11 females, 19 mi W of Klamath Falls, 24 June 1971 (P. Oman); 1 male, 20 mi E of Seneca, 14 Aug. 1971 (P. Oman); 3 males, 1 female, 12 mi W of Silver Lake 5000' [1500m], Lake Co., 12 July 1978 (P. Oman); 11 males, 4 females, Johnson Meadow, Klamath Co., 17 July 1979 (P. Oman); 1 male, 2 females, north edge of Big Lake 4650' [1350m], Linn Co., 1 Oct. 1979 (P. Oman); 2 males, 2 females, Saunders Lake 2 mi N of Hauser, 8 Oct. 1979 (P. Oman); **WA.**- 2 mi S of Humptulips, 22 Aug. 1971 (Viraktamath). Holotype and 240 paratypes No. 22877 in CNC; 190 paratypes in OrSU, 13 paratypes in MLBM, 3 in University of Kentucky, Lexington and 1 in AMNH.

Additional records, based on unassoci-

ated females and therefore excluded from the type series, are: **CA**- Fort Ord., 2 mi E of Gasquet; **OR**- 2 mi E of Carlton, Merlin, Mt. Vernon, Odell, Sams Valley (N of Medford), Skookum Meadow (Klamath Co.).

Remarks. Distinguished from *M. quad-*

rilineatus and related species by the angulate apophyses of the male 2nd sternal apodeme, and by the unusual length of the 2nd acrotergite “neck.” This species appears to replace *M. quadrilineatus* as the most common temperate-zone *Macrosteles* west of the Rocky Mountains.

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